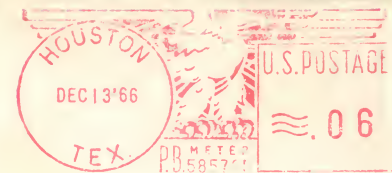


ORIGOS DIGITAL MACHINES

INFOTRONICS CORP.

7800 WESTGLEN DRIVE
HOUSTON, TEXAS 77042



PRINTED MATTER



INFOTRONICS CORP.

7800 WESTGLEN DRIVE
HOUSTON, TEXAS 77042
PHONE SU 2-9770 - TWX 713-571-2154

Nelson, Systems Consultants
Box 1546
Poughkeepsie, New York 12603

HERE IS THE INFORMATION YOU REQUESTED

POSTMASTER: This parcel may be opened for postal inspection if necessary. Return postage guaranteed.

CRS-40

Chromatograph Data Processing System



CRS-40R



CRS-40P

A NEW advanced performance magnetic tape data collection and processing system for analytical chemistry

The new CRS-40 system encompasses two major sub-systems: one or more portable magnetic tape recorders (CRS-40R); a central tape playback-process system (CRS-40P). Data can be collected from tape recorders at analyzers in several diverse locations. All tapes are then processed in the centrally located playback-process console.

BENEFITS

- Rapid availability of processed information from a number of chromatographs with wide dynamic range performance.
- Increased efficiency in use of a single integrate and printout system for the total output of several chromatographs.
- Reduced man-hour requirements—with concurrent advantage of reduced human-error possibilities.

- Digital readout of peak areas and peak retention times.
- Optional computer - compatible outputs.
- Playback-process speed is 4 or 16 times recording speed—data from up to 20 analyzers in relatively continuous operation can be processed by one CRS-40P system in single shift operation.
- Tape recorders CRS-40R—available with one (CRS-41R), two (CRS-42R) or three (CRS-43R) data channels.
- B-5 Automatic Baseline Drift Corrector built-in to CRS-40P console.
- Optional peak corrector, programmer for correction factor application, and normalizing circuitry.

 **INFOTRONICS**
CORP.

7800 Westglen Drive • Houston, Texas 77042
PHONE: (713) SU 2-9770 • TWX 713-571-2154

FORM No. 100-2-66

CRS-40R

Data Collection Recorders

CRS-40R recorders are available in a wide range of models, all with solid-state circuitry—Standard models with $1\frac{7}{8}$ ips recording speed include:

	Wide Dynamic Range (H)	Extra Wide Dynamic Range (HS)
1 data channel	CRS-41RI	CRS-41RSI
2 data channels	CRS-42RI	CRS-42RSI
3 data channels	CRS-43RI	Not Available

Optional two speed recording, 15/32 and $1\frac{7}{8}$ ips, is available on all models (option D). Recorders may be readily connected in parallel with any chromatograph recorder. In routine work, when an on-the-spot visual record is not required, the chart recorder may be eliminated. Controls permit tape recording of identification data (run number, sample type, etc.).



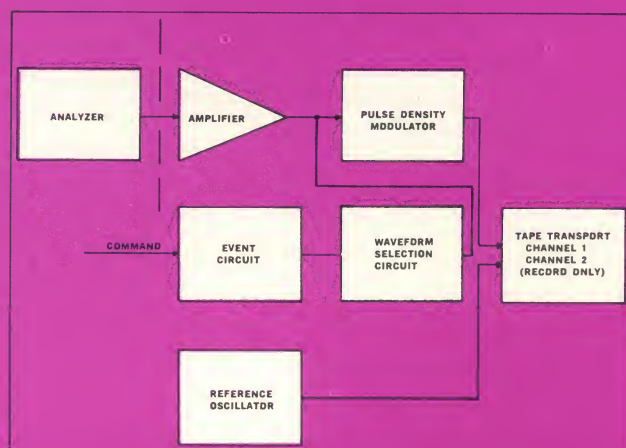
CRS-40R

OPERATION

The first step in the operation of the CRS-40R is to insert the tape reel in place. A reel holds 1200 feet of 1-1/2 mil mylar tape, recording at $1\frac{7}{8}$ or 15/32 ips, providing two or eight hours recording time. Thinner tapes may be used for longer times. By switch settings the operator may record on tape a series of data identification digits. To record an analysis, engage the tape drive lever and, after a few seconds, push the chromatograph event button at the sample insertion time. Recording then continues until run end. Completed tapes are directly compatible with the central playback facility.

RECORDER DESCRIPTION

The basic CRS-40R data collection recorder comprises a multi-channel magnetic tape system employing pulse density modulation recording techniques. The analyzer output signals and a noise-cancelling signal are recorded on tape. The analytical signal first passes through a signal conditioning amplifier and is then pulse density modulated. Signal information is now contained in varying pulse repetition frequency. The noise-cancelling signal will be used on playback to minimize tape transport noise and thus improve fidelity of the record/reproduce cycle. The CRS-40R has a built-in preamplifier



with 0-50 mv and 0-500 mv input ranges equivalent to the 50 mv or 500 mv range of the CRS-11H digital integrator. It can be connected directly to analyzer outputs of 1 mv full scale or greater. The tape recording, storage, and playback operation has the sensitivity on the 50 mv range of a standard 1mv instrument and will reproduce the original analytical signal with minimum degradation, so that digital integration will produce the same values, within a very close tolerance, when processing a signal in real time and when processing a tape recorded, played back version thereof. Extra wide dynamic range recording may be obtained with a special recorder and playback modification which permits performance equivalent to the CRS-11HS Auto-switching Integrator. Specify CRS-40RS models.

CRS-40P

Central Data Processing System

The CRS-40P Central Data Processing System incorporates all equipment necessary to reproduce analyzer signals, integrate peak areas, and present results in digital form. Major sub-systems include the tape playback unit (CRS-40TS), automatic digital integrator (CRS-11HSB/42), automatic baseline drift corrector (B-5), and digital printer. All equipment, excluding the printer, is packaged in two CRS-11 size cabinets. Electronic circuitry is all solid state. A single playback system can process the output of several analyzers; the exact number capable of being processed in a single shift operation will depend upon average duration of the chromatograph runs. Since playback speed will be 4 or 16 times recording speed, a 30 minute chromatogram can, e.g., be processed in 7.5 or 2 minutes. The number of analyzer units to be handled by a single CRS-40P

PLAYBACK SYSTEM UNITS

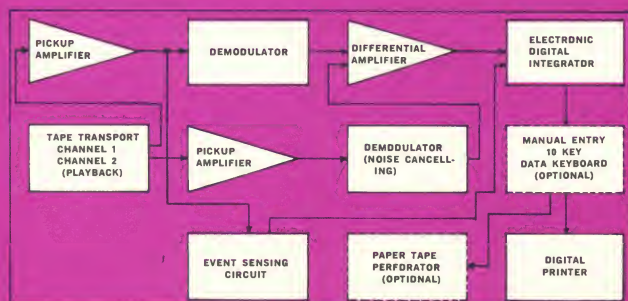
CRS-40TS Tape Playback Unit—The tape playback incorporates a tape transport identical with the field units. Field tapes normally are played back at 7.5 inches/sec—4 or 16 times the original recording speed. On playback both the analytical signal and the noise-cancelling signal are demodulated, then the two signals are mixed. In this manner, tape transport noise effects are minimized. The reproduced analytical signal is fed to the CRS-11HSB/42 digital integrator. Peak detection and area integration is then automatic as described in the CRS-11HS data sheet.

CRS-11HSB / 42 Digital Integrator — The CRS-11 HSB/42 is an all solid-state circuit design, with extended dynamic range, which processes data from the CRS-40TS and also directly from a chromatograph if it is desired for any reason to bypass the tape transfer. Automatic peak detection is as sensitive as on the 1 millivolt full scale range of standard INFOTRONICS digital integrators (i.e., 0.2 microvolt/sec. slope change), yet it has a linear input range of 0-500 mv. Details of CRS-11HSB/42 operations and performance specifications are described in the CRS-11HS data sheet.



CRS-40P

depends upon analyzer loading, down time, etc. In typical operations, up to 10 or 20 analyzers in relatively continuous operation can be processed by one CRS-40P system.



B-5 Automatic Baseline Corrector—Proper baseline control and baseline stabilization

at the start of the playback run are very important in accurate integration. The model B-5 corrector, an all electronic unit built-in to the CRS-11HSB cabinet, performs this function automatically. It is a standard version of the model B-5 described in the INFOTRONICS B-5 automatic baseline drift corrector data sheet.

Digital Readout—The usual digital presentation is a list of peak areas and associated peak retention times, printed on adding machine tape by the model P-1 digital printer. Tape recorded identification digits are printed in serial form. A number of special computer compatible outputs are available. The most practical of these are via punched paper tape perforator, model T-1, which punches time and area data serially by character in the desired computer code and format or using the model T-3 combination printer/tape perforator.



Combination Printer/Tape Perforator

SPECIAL CRS-40 SYSTEMS

A variety of special modifications of the basic CRS-40 models is available, providing for biochemical applications and for computer data collection.

Computer Data Collection (A/D Systems)

INFOTRONICS type CRS-30D programmed digitizer can be added to the CRS-40 playback system to provide sampling, encoding, and digital recording of tape recorded data in computer compatible format. The CRS-30D system can offer selection of sampling intervals and gate widths. Digital output usually is on punched paper tape. Details are set forth in the CRS-30D product data sheet.

Biochemical Applications

Special recorders, designated as A models are offered for long duration analyses, e.g., amino acid analysis and colorimetry. These incorporate built-in function converters. Available models include:

CRS-41RAI—single data channel

CRS-42RAI—two data channels

CRS-43RAI—three data channels

Either a Beers' Law (type L) or adjustable (type FG) converter may be specified. Tape speeds are 3/16, 3/8, 3/4 ips—selectable. The two channel recorder may be used to record simultaneously, e.g., the 440 and 570 millimicron channels of an amino acid analyzer.

A playback center for *amino acid analyzer data* will include either—

CRS-40TS tape playback unit with CRS-11AB/41 Single Channel Digital Integrator; or

CRS-40TS-2 tape playback unit with CRS-12AB/43 Dual Channel Digital Integrator.

Digital readout—P-1 printer or T-3 printer/tape perforator. At 7.5 ips tape playback speed, processing time is cut to 1/40, 1/20, or 1/10 reading time. You can add peak correction, correction factor programming, and normalization for complete data processing.

A playback center for *colorimetric applications* can be obtained by specifying the CRS-75 peak height digitizer in lieu of a digital integrator. See the CRS-70 product data sheet.

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ADD COMPLETE DATA REDUCTION CAPABILITY TO A CRS-40 SYSTEM AT A REASONABLE COST

- Apply correction factors to peaks
- Normalize to obtain results as percent total sample

First--Collect data from many analytical instruments in reproducible form, at an economical unit cost, using CRS-40R series magnetic tape recorders.

Then--Process data fully with our expanded CRS-40 playback center, including:

CRS-40TS tape playback unit
CRS-11HSB/42 digital integrator
Model G digital peak corrector
Model NO normalizing circuit
PR-50 correction program reader
T-3 page printer/tape perforator

Here's how data processing is done:

- Magnetic tape-recorded analyses are loaded on the CRS-40TS tape playback unit.
- Correction programs have been punched into program tapes using the keyboard of the T-3. Tapes may contain analysis headings as well as correction factor programs. Correction factors may be programmed for peaks or groups of peaks according to retention time or peak sequence, i.e.,

factor i applies from t_i to $(t_i + \Delta t)$
or factor g applies from peak numbers k to $(k + n)$

A library of programs for various analyses can be built up.

- Load the program tape for the analysis at hand in PR-50 programmer.
- Set 3 digit correction factors on the panel of the G peak corrector. Application of the proper factor to the proper peaks will be controlled by the PR-50.
- Play the magnetic tape back to calculate corrected total sample area

$$\sum_n a_i A_i$$

where a_i are the correction factors

A_i are the raw peak areas

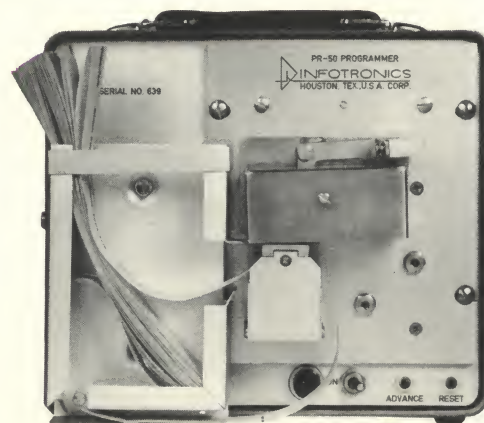
n is the number of peaks in the analysis

- Replay the tape again and the corrected total will automatically be used to normalize peak areas. The T-3 will print answers expressed as percent total sample, i.e.,

$$\frac{a_i A_i}{\sum_n a_i A_i} \times 100$$

These are some of the advantages:

- Tape recorded analyses are available for replay as needed to optimize results.
- The T-3 manual keyboard is available to enter data and comments on the completed analysis sheet.
- The same T-3 unit can be used for correction program preparation.
- Panel display and controls for easy checking and change of correction factors
- Economical cost per analytical instrument. Particularly suitable for a moderate number of analyzers, e.g., 5-25 chromatographs. Compare the cost per analyzer with other data processing methods.



PR-50
Correction Factor Programmer

HOW TO ORDER

Magnetic tape recorders

No. channels	Dynamic Range	
	H	HS
1	CRS-41RI	CRS-41RSI
2	CRS-42RI	CRS-42RSI
3	CRS-43RI	not available

All models provide identification data recording. To omit, drop the letter I in the model number. All units provide 1-7/8 ips recording speed. Selectable dual speed is available as an option on all models, at 15/32 and 1-7/8 ips — add the letter D to the model number, e.g., CRS-41RSI/D.

Special models for amino acid analysis, colorimetry, etc., may be ordered in 1, 2, or 3 channels by adding A to the H range model numbers. These offer both linear (H range) and Beers' Law recording, e.g., CRS-41RAI. Tape speeds are 3/16, 3/8, 3/4 ins selectable.

Gas chromatograph playback center

The minimum system will include:

- CRS-40TS playback system which accepts tape from *any* model recorder
- Digital integrator — CRS-11HSB/42 for tape playback or direct connection to chromatograph. When integrator is to be used for tape playback *only*, specify model CRS-11HSB/40
- Digital readout — e.g., P-1 digital printer or T-3 combination printer/tape perforator
- For complete data processing, including peak correction and normalization add —
- Model G digital peak corrector, specifying the number of correction factors needed, e.g., G-15
- Model NO normalizing circuit
- Model PR-50 correction factor programmer

Special playback systems for amino acid and colorimetric applications are available. Note that both gas chromatograph and amino acid records can be processed by specifying a model CRS-11HSB/42A integrator; this integrator can process GLC data from tapes or directly from the chromatograph and AAA data from tapes *only*.

Consult your INFOTRONICS sales engineer or representative for assistance in writing specifications for your particular problem.

CRS-40 SYSTEM GENERAL SPECIFICATIONS

Portable Magnetic Tape Recorders—CRS-40R

Input type.....	Floating or single-ended
Input range.....	0-50 mv; 0-500 mv selectable, 20% over-range
Input impedance.....	500K ohms
Data channels	One (CRS-41R); two (CRS- 42R), or three (CRS-43R)
Noise-cancelling channel...	On all models
Identification data.....	Recorded serially on tape
Tape recording.....	Pulse density modulation
Nominal data bandwidth...	10 cps
Pulse frequency deviation...	72-2472 cps

} @ 178, proportional
at other speeds

Tape width.....	1/4"
Reel size.....	7"
Reel capacity.....	1200 feet, 1 1/2 mil mylar tape; 1800 feet, 1 mil mylar tape
Recording tape speed.....	1 7/8 ips, standard 15/32, 1 7/8 ips, D models 3/16, 3/8, 3/4 ips, A models
Recording time	Up to 180 minutes, standard; 720 minutes, D models 1800 minutes, A models
Size.....	17" X 17" X 8" high
Power requirements.....	.50 or 60 cps standard power lines; 120 or 240 v

Central Data Processing System—CRS-40P

Playback tape speed.....	7 1/2 ips or 17 1/8 ips
Playback mode.....	Sequential from multi-channel tapes
System accuracy.....	0.5% of indicated value $\pm 4\mu\text{v}$ relative accuracy for complete record/reproduce process. Repeatability of area values in multiple playbacks — $\pm 0.1\%$ of indicated area from 100 % to 0.5% full scale
Retention time start.....	From playback of recorded GLC event signal
Digital integrator.....	Specifications of CRS-11HSB digital integrator
Baseline corrector	Specifications of B-5/11 automatic baseline drift corrector
Digital output	Standard-printed tape from P-1 digital printer (Victor), 3 digits of time, 7 digits of data. Time and area for each peak on a single line. Serial printing of recorded identification digits. Optional—T-1, 5-8 hole code punched tape perforator [Friden] in computer compatible format. —T-3, combination printer and tape perforator

CRS-11HSB

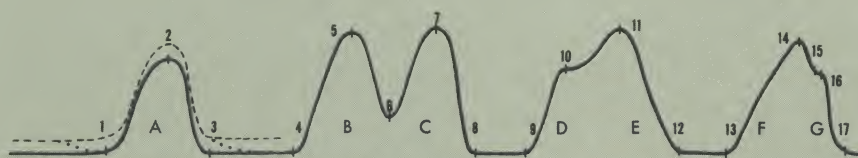


AUTOMATIC/EXTENDED RANGE ELECTRONIC DIGITAL INTEGRATOR

PROVIDING LABOR-SAVING, FULLY AUTOMATIC,
ACCURATE DIGITAL INTEGRATION PLUS DIGITAL
PRINTING OF PEAK TIMES AND PEAK AREAS
IN CHROMATOGRAPH AND OTHER ANALYSES

 **INFOTRONICS**
CORP.

HOW THE CRS-11HSB SEPARATES AND INTEGRATES PEAKS



A. Perfectly resolved peaks

Integration automatically starts at 1; peak retention time is measured at 2 and memorized; at 3 integration stops, area is transferred to memory for printing. Time and area are printed on the same line.

B. Overlapping peaks

Integration starts at 4; time is read at 5; integration stops at 6, data transfers electronically to memory, area counter is cleared and starts integrating the overlapping peak, with printout following from memory; peak time is detected and memorized at 7; integration stops at 8, area of second peak in doublet is transferred and printed.

C. Peak shoulders

Poorly resolved peak shoulders can be separated and integrated as shown in the diagram both on leading and trailing edges of peaks. Peaks are separated at 10 and 15. Although obviously not the true areas for the shoulder component, areas obtained often are useful in quantitation.

D. Automatic baseline drift correction

After each peak, e.g. at 3, corrector is turned on, monitors integrator baseline, and if this is not zero, the corrector adjusts toward zero and controls there. Corrector is turned off at the start of the next peak, e.g. 4. Corrector does not operate between overlapping peaks (e.g. at 6, 10, and 15). Corrector does *not* operate ahead of and thus cannot desensitize the peak sensor.

Special Extra Performance Options

AA — Automatic attenuator to keep recorder signals on chart — steps at 1, 5, 10, 50 mv

ED — Exponential decay correction program, selectable rates to compensate for solvent or other large peak "tailing"

LR — Logarithmic compression of recorder signal to keep wide range of peak heights on the recorder chart

W — Minimum peak size control. Adjustable settings to reject all peaks below a minimum area count.

Magnetic tape capability — pre-wiring for use with INFOTRONICS CRS-40 magnetic tape systems, specify CRS-11HSB/42

Computer compatible outputs—special digital outputs available on punched tape (PT), punched cards (CP), incremental magnetic tape

Complete computation capability — application of correction factors and normalization to get results in percentage composition. Ask for data on the INFOTRONICS CRS-50 Analytical Computation Center.

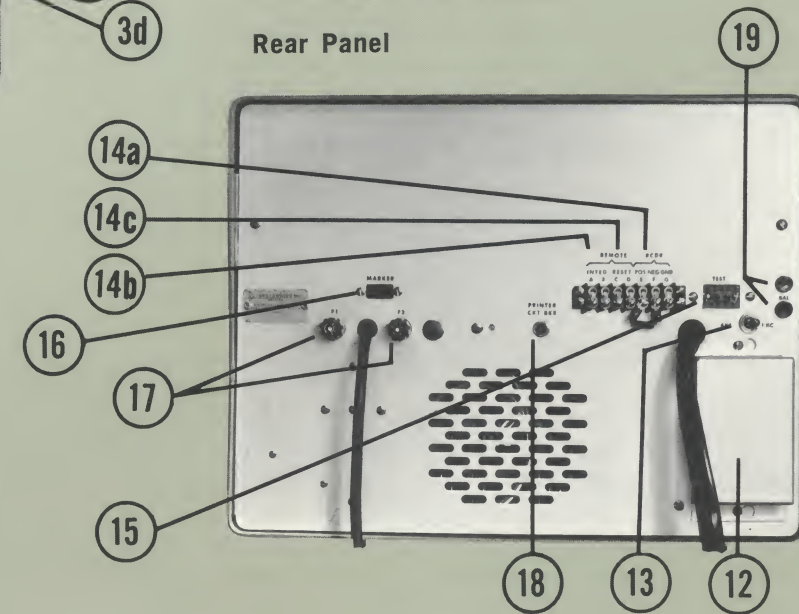
PRINTED TAPE FORMAT

PEAK ON CHART—

A	7 5	7 1 6 3 5
B	1 8 1	1 0 2 9 9 7
C	2 1 5	1 1 0 0 3 5
D	2 6 9	3 1 7 1 1
E	2 8 9	1 0 7 8 2 9
F	3 5 0	4 9 6 2 5
G	3 6 1	1 6 9 2 5
		4 9 0 7 5 7 T

PEAK TIME - | PEAK AREAS
SEC. | AND TOTAL

Rear Panel



1. Multiple input selector switch (1-5)
2. Input range selector (0-50 mv, 0-500 mv, AUTOMATIC range change)
3. Automatic peak detection controls
 - a. Threshold level (resolution of shoulders)
 - b. Trip level (over-all sensitivity)
 - c. Slope sensitivity (set minimum slope threshold)
 - d. Filter (rejection of high frequency noise)
4. Manual time and data recording
5. Operation mode selector: Power OFF, RESET (Standby, power on), MANUAL, AUTOMATIC positions
6. Automatic baseline corrector tracking rates, separately selectable up and down
- 6a. Indicator lights show direction of tracking of automatic baseline corrector
7. Automatic fast baseline balance control
8. Zero adjust and monitor
9. Visual display of peak area and retention time
10. Integration status monitor—red indicates integration is in process
11. Peak status lights; P = integrating rising portion of peak; N = integrating falling portion of peak
12. Multiple input connection terminals
13. Area count rate selector (1 or 4 kc/mv)
14. Remote output/control terminals
 - a. Isolated output to chart recorder (E, F)
 - b. Remote control of integration (A, B)
 - c. Remote reset (C, D)
15. Test outlet for instrument check-out
16. Recorder marker pen output
17. Power fuses, a-c and d-c
18. Circuit breaker protector
19. Automatic peak detector balance test points

OPERATING INSTRUCTIONS

The CRS-11HSB is easily connected by two conductor shielded cables to the output of an analytical instrument. Connection is to the rear panel terminal posts (12). The CRS-11HSB may be connected at a point ahead of automatic or manual chromatograph output attenuators, which then may be operated without affecting CRS-11HSB operation. The CRS-11HSB provides an isolated output (14a) to feed the chromatograph output through the system preamplifier to the chart recorder, thus preventing loading errors in the chromatograph if the recorder is overdriven. To select a particular chromatograph signal for integration, the multiple input selector (1) is used. Most analyses can be run in AUTO range setting (2). In this position, the input range is 0-500 millivolts. An automatic range change (X10) takes place at the 50 millivolt level with count rate into the peak area counter also automatically scaled (X10). Peak areas can then be read directly without further arithmetic. Fixed ranges of 0-50 and 0-500 millivolts also are available. In the AUTO and 0-50 mv ranges, input sensitivity is 1000 or 4000 counts/mv of input, switch selectable (13) and minimum slope detection threshold is 0.2 microvolts per second. The 0-500 mv range has less input sensitivity and a higher minimum slope detection threshold, both by a factor of 10.

For a given problem, a specific set of automatic peak detection controls will apply (3). Trip level, slope sensitivity and filter frequency are set as sensitive as input noise signals and analysis speeds permit. Each can be adjusted independently. Once determined, control settings seldom must be varied. For widely different types of analyses, e.g. sharp, closely spaced peaks in capillary column work to very broad, gently sloping peaks in some TC, packed column applications, different automatic peak detection control settings may be required.

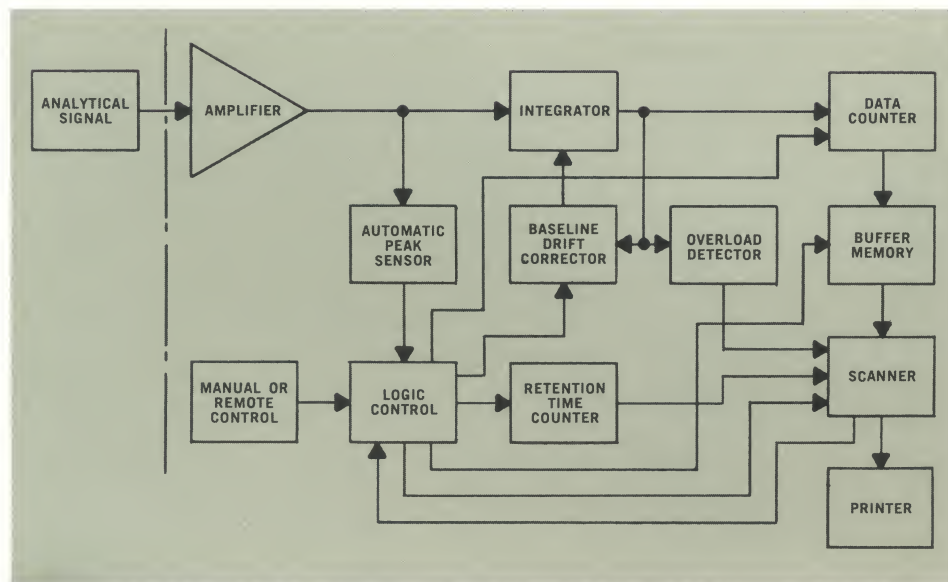
A separate level control permits resolution of peak shoulders when no discernible inter-peak valley oc-

curs. Four control regions permit: a) separation of shoulders on both leading and trailing edges of peaks, b) separation of leading edge shoulders only, with trailing edge shoulders treated as end of peak, c) separation of trailing edge shoulders only, d) no separation of shoulder peaks, with trailing edge shoulders treated as end of peak.

Prior to a run, the CRS-11HSB is easily set to zero reference. With the automatic baseline corrector option, zero adjustment is done automatically by the corrector, and a monitor light indicates a balance condition. Momentarily pressing the FAST button (7) will cause the balance to be achieved at a rate of 300 $\mu\text{V}/\text{sec}$, with the proper slow tracking rate automatically resumed when balance is achieved. Automatic tracking range is from $-.1$ to 2.5 mv. Zero can be adjusted manually, employing the control knob and flashing light monitor (8). To make a run the mode switch (5) is turned from RESET to AUTO at sample injection time, activating the peak detection circuits and starting the peak timer. Peak detection and integration is then fully automatic and may be monitored by the digital display (9) and integration status lights (10 and 11). The accessory digital printer prepares a listing of peak areas and associated peak times as the individual peaks are eluted. At run end, a TOTAL button on the printer provides a printout of total area of all peaks in the run. The solid state circuitry of the CRS-11HSB requires little warmup, so that the system power (5) may be turned on a few minutes prior to a run, or the CRS-11HSB may be left powered in RESET position at all times.

The CRS-11HSB system incorporates a transistorized preamplifier, with high impedance, isolated input. The amplifier conditions the signals to the proper level for automatic peak detection and integration and also acts as a noise rejection and impedance matching network. Integration is accomplished by the voltage-to-frequency conversion/pulse

counting technique. The integrator develops a high frequency pulse train, whose frequency varies precisely proportional to the chromatograph signal. Pulses are fed to an electronic counter. Automatic peak detection circuitry turns the counter on only during a peak, thus the counter accumulates a count total proportional to peak area. For readout, peak area values are transferred to an electronic memory register. Printing is from this register, so that integration of a closely following peak may begin without waiting for the relatively slow printer operations.



PERFORMANCE FEATURES OF CRS-11HSB

The new CRS-11HSB is an all-transistorized printing electronic digital integrator for use with a variety of gas chromatographs and other analytical instruments. Features previously available as extra-cost options in our CRS-10 integrator are standard in the CRS-11HSB. Input may come from any analyzer electrical output of one millivolt full scale or greater. Peak area and peak retention times are visually displayed and printed in digital form. Operation is fully automatic and extended, automatically scaled dynamic range permits unattended operation in a wide range of problems.

Fully automatic peak detection and integration

A peak sensor sensitive to signal rates of change as small as 0.2 microvolt/second and signal fluctuations as small as 1.25 microvolt controls area integration and time measurement. Special combined slope/signal level criteria permit separation of poorly resolved shoulder peaks.

Memory for accurate integration of closely spaced peaks

After completion of integration of a peak area, the digital value is transferred to an electronic memory from which printing occurs. The area counter is immediately free to begin integrating the next peak.

Digital display and printing of peak areas

Area of each peak is displayed on an in-line digital light display and is printed on adding machine tape. Computer compatible output on a punched tape perforator is available.

Solid state circuit modular construction

All circuitry is solid state. Most circuits are mounted on plug-in cards for easy access and troubleshooting.

Event pen monitor of integration on chart record

When a chart recorder is available in the analyzer system, the CRS-11HSB provides a monitor signal to the recorder event pen, marking start and end of each area integration cycle.

Five input selector switch

Rear terminals permit permanent connection of up to 5 analyzers to the CRS-11HSB. The particular analyzer to be processed is selected by a front panel switch.

Compatible with all common types of analyzers, independent of recorder

The CRS-11HSB input connects directly to the electrical output of the chromatograph. It is independent of and does not interact with chart recorders.

Extended dynamic range permitting unattended operation, without attenuation

The CRS-11HSB retains the full peak detection sensitivity of previous 1 millivolt full scale input range models, but permits linear integration of peaks as high as 500 millivolts, an effective 500 to 1 range extension.

Measurement, display and printing of peak retention times

For each peak, elapsed time from run start to peak crest is measured, displayed and printed alongside the associated peak area value.

Provides automatic zero and baseline control

A continuously monitoring, self-correcting automatic baseline corrector with independently adjustable up-and-down tracking rates and automatic fast balance is available either as a built-in or separately packaged accessory.

Maximum flexibility of automatic peak detection

Three separate controls permit independent adjustment of automatic peak detector sensitivity, baseline drift rejection, and rejection of high frequency noise. An additional control sensitive to signal level permits separation of poorly resolved "shoulder" peaks.

Computer compatible outputs

Options permit recording of CRS-11HSB areas and times in computer compatible formats, e.g., on punched tapes. Design also permits tie-in to data logging and computer control systems.

CRS-11HSB SPECIFICATIONS

Input sensitivity: 1000 or 4000 area counts/second per millivolt of input signal, switch selectable

Input ranges: 3 selectable ranges—0-50 mv, 0-500 mv, AUTO = 0-500 mv with sensitivity of 0-50 mv range and automatic (X 10) range switching. When range is switched in AUTO, area counts are properly scaled so that printed areas are correct with no further computation required.

Input overload: 20% linear overload on all ranges with overload automatically detected and printed

Input impedance: 500,000 ohms

Input termination: Isolated (floating) or single-ended

System linearity: Typically $\pm 0.25\%$ of actual input signal ± 2 microvolts

Accuracy: Typical reproducibility of peak area and peak area ratio values is $\pm 0.1-0.2\%$ or better

Automatic peak detection:

- Selectable level sensitivity settings to 1.25 microvolt
- Selectable filtering for optimized noise rejection; 10, 3, 1, and 0.3 cps
- Maximum slope detection sensitivity—0.2 microvolts per second
- Combination (slope/signal level) detection mode for resolution of shoulder peaks
- In manual mode, integration process controlled by operator

Area count resolution: 1 count in 10,000,000

Maximum count rate: 200,000 per second full scale on 50 and 500 mv ranges; effective 2,000,000 per second on AUTO range. These high count rates used for precise automatic baseline control; 4:1 or 1:1 countdown prior to area count accumulation.

Peak readout resolution: Maximum of 2 peaks in 1 second on 50 and 500 mv ranges, 2 peaks in 1 second to 1 peak per 2 seconds on AUTO range, depending on peak size

Peak area memory: Digital readout is from buffer memory, permitting accurate integration of closely spaced peaks

Peak area count accumulator: 7 decimal digits

Peak retention time mode: Measures elapsed time from zero time to peak crest

Peak retention time resolution: Nearest second is standard; other units optional

Peak retention time accumulator: 3 digits with recycle after 999, extra digit optional

Visual digital display: 10 in-line digits, 3 time, 7 data. Can be omitted as cost-saving option.

Zero control: Fully automatic when built-in B-5/11 baseline corrector is specified; visual light monitor and manual adjust knob provided

Digital printout format

- Ten digit single line presentation
- Three digit retention time in left columns (10, 9, 8)
- Seven digits of area in right columns (7, 6, 5, 4, 3, 2, 1)
- Total area of all peaks printed with symbol T in right margin
- Nonlinear overload of input-symbol N printed in right margin

Circuitry: Solid state circuits, plug-in cards

Dimensions: 17" x 17" x 13"

Power requirement: 250 watts peak, operates from standard 50-60 cps power lines

ORDERING INFORMATION

Description	Model Number	Description	Model Number
Systems			
Complete auto/extended dynamic range digital integrator system with built-in automatic baseline corrector	CRS-11HSB	Externally packaged automatic baseline corrector	B-5/10
For use with CRS-40 Magnetic Tape Systems	CRS-11HSB/42	Omit visual display	U-11
Digital integrator, extended range, 0-50, 0-500 mv ranges; no AUTO range — no automatic range changing	CRS-11HB	Parallel output to printer/tape perforator	PT-11
Options		Digital Readouts	
Omit automatic baseline corrector	B-11	Heavy duty serial entry digital printer	P-1
		5-8 hole code paper tape perforator	T-1

Form No. 102-3-66



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CORP.

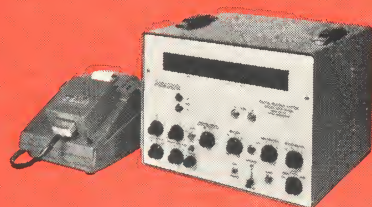
INFOTRONICS

Specialized Instrumentation for Digitizing Analytical Data in . . .

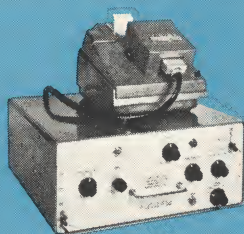
- Gas Chromatography
- Amino Acid Analysis
- Automatic Colorimetric Analysis

INFOTRONICS offers you a wide range of models and options, allowing you to select the instrument that pro-

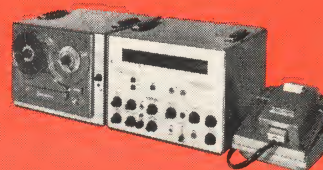
vides optimum benefits for your special application.



CRS-11HSB — Automatic Extended Dynamic Range Integrator



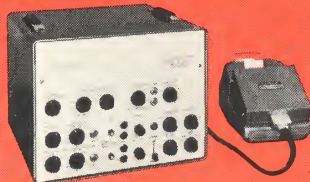
CRS-10H — Automatic, Expanded Range Integrator



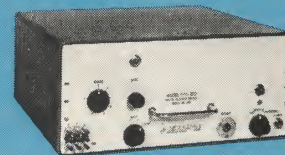
CRS-40 — Magnetic Tape Data Collection and Processing System



B-5 — Automatic Baseline Drift Corrector



CRS-12A — Dual Channel Integrator for Amino Acid Analyses



CRS-30D — Computer Data Collection System

The responsibility of leadership is a determining factor across the board at INFOTRONICS. Unceasing research. Design, development and manufacture of progressively improved instruments. World-wide sales and service facilities. The leader cannot ignore the challenge to continually improve — product and service.

INFOTRONICS...

Pioneer and leader in

- Electronic digital integration
- On-line peak height digitizing
- Computer data collection systems
- Magnetic tape data processing systems

CRS

The mark of leadership

 **INFOTRONICS**
CORP.

Integrates Receiver With Automatically Controlled Memory
Integrates advantages of *chassis speed processor*. Compatible with all common types of analyzers.

CRN-108 System with **ELI Associates Receiver CRN-108** and **P-1 Processor**

A *4-channel*, *up to 100,000 cps* *transmission* *processor*, *digital* *integrator*. Adaptable to *pressure* *or* *in* *laboratory* *type* *applications*. Capable of *1 gpm* *per* *second* *or* *1* *in* *one* *second*. *Most* *used* *Electronic* *memories* *perform* *automatic* *integrations* of *chassis* *speed* *processors*.

Announcing A Training Course For Amino Acid Analysis Applications

On December 5, 5 a training course emphasizing applications of digital integrators to amino acid analysis will be conducted. Location will be the **INDOTRONICS**, Houston plant, 7800 Westport Dr. Subsequent sessions will be held at the integrator operation, data reduction and integrator maintenance.

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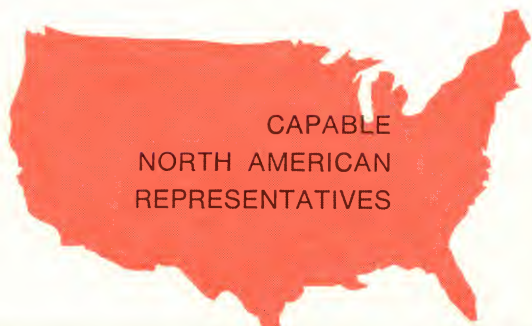
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INFOTRONICS

CRS-30 DIGITIZING SYSTEMS



PRINTED DIGITAL READOUT OR DIGITAL DATA COLLECTION
FOR COMPUTER PROCESSING OF SPECTROPHOTOMETERS,
COLORIMETERS, AMINO ACID ANALYZERS AND OTHER
ANALYTICAL INSTRUMENTS.



FEATURES...

- All solid-state circuit plug-in modular construction.
- Uses integrating type of digitizing, eliminating errors due to electrical noise.
- Digitizes millivolt signals directly—no mechanical or electromechanical converters required.
- Wide dynamic range of voltage measurement without auto ranging.
- Expandable to permit scanning for multiple inputs.
- All types of output devices available, including printers, paper tape punches, card punches and incremental magnetic tape recorders.
- Many options available to allow ordering the system that meets your specific requirements.
- With correct options, systems can give direct print-out of final answers in the desired units for many analytical instruments.

DESCRIPTION

INFOTRONICS offers a wide variety of solid state digitizers under the name CRS-30. To the basic system (shown in the block diagram) many options may be added to obtain a digital readout system to meet most any requirement. The distinctive feature of all CRS-30 digitizers is the wide dynamic voltage range over which accurate measurements may be made without any form of attenuation. For example, on the 10 millivolt scale, accurate measurements may be obtained over full-scale even though the actual voltage range is only 0-1 millivolt.

With expanded systems such as the CRS-30E or CRS-30AE, a printed list of final answers in concentration may be obtained from the output of many analytical instruments. The CRS-30 can also be expanded to a data acquisition system having computer compatible output. A choice of one of three outputs is standard: printer, paper tape punch or incremental magnetic tape recorder. A card-punch coupler is available as an option.

Several typical expanded systems are described on these pages, and the many available options are given on the back. If none of these typical systems meet your particular needs, send us your requirements and let Infotronics application engineers propose the system that does. If automatic peak height digitizing is needed, ask for the brochure on the CRS-70 system.

CRS-30 BASIC SYSTEM

The basic system can be either a fixed-range, printing digital millivoltmeter or a single channel, low-level analog-to-digital converter with a computer compatible output. See block diagram.

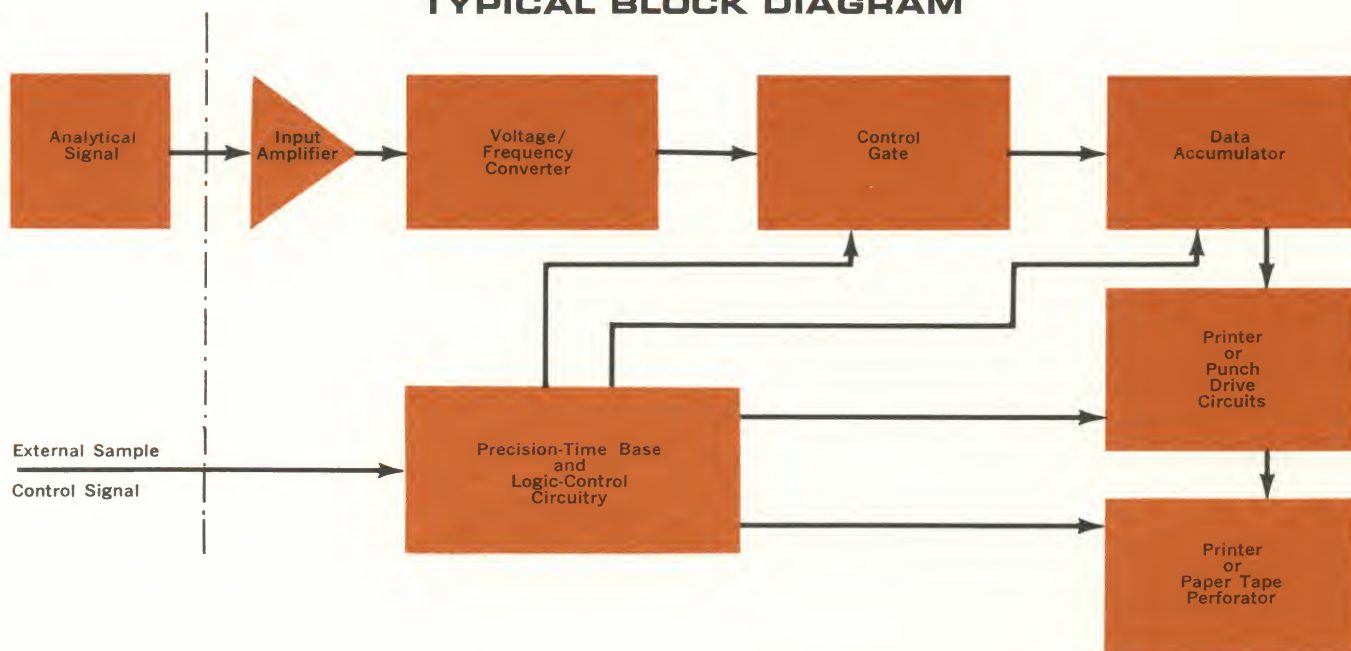
The basic CRS-30 system consists of a chopper-stabilized, transistorized amplifier with unusually wide dynamic range feeding a precision voltage-to-frequency converter. The pulses from the v/f converter are gated into an electronic counter with the gating controlled by a .01% frequency standard time base. The accumulated digital number is then scanned to drive the appropriate output device sequentially by digits.

Two modes of operation are available. One mode provides for digitizing on command from a pushbutton or an external signal. The other mode is repetitive digitizing.

PRINTED TAPE FORMAT (For Systems with Sample Numbering)

SAMPLE NO.	1	1	DATA LISTING
	2	1	
	3	1	
	4	1	
	5	1	
	6	70	
	7	82	
	8	81	
	9	40	
	10	7	
	11	1484	
	12	4274	
	13	14294	
	14	28091	
	15	45689	

TYPICAL BLOCK DIAGRAM



SIMPLIFIED BLOCK DIAGRAM—BASIC CRS-30 SYSTEM

TYPICAL SYSTEMS

CRS-30E

The CRS-30E is an expanded system that can be used as a digital readout device for a variety of analytical instruments. In addition to the basic system it includes a 2-digit sample number, selectable input ranges and digitizing periods, output scaling to give readout in desired units and memory to allow continuous repetitive digitizing. The output can be for either a printer, paper tape punch or incremental magnetic tape recorder.

CRS-30AE

The CRS-30AE system is identical to the CRS-30E except that it incorporates an electronic function-former for use with non-linear response signals. The function-former can be either a fixed, 11-point curve for a specific application such as Beers Law detectors or it can be a 6-point, adjustable type to allow matching a variety of curves.

CRS-30D

The CRS-30D is expanded over the basic system in that the input range selector, digitizing period selector and memory allow continuous repetitive digitizing. The general application of this system would be the same as the basic CRS-30 but it would have more versatile operation for general laboratory use.

CRS-30M/N

The CRS-30M/N is a multiple input, low-level digitizer with an input scanner having a sequential scanning rate of two channels per second or slower. In addition to the basic system, this system provides scanning capability, memory, and input channel numbering. (N designates the number of channels.)

Note: the output device selected must be compatible with the scanning rate.

CRS-30S/N

(Specifications listed do not apply to the CRS-30S/N)

The CRS-30S/N is a high level multiple input digitizer with input scanner having high speed sequential scanning at the rate of up to 45 samples per second. Input sensitivity is 20 volts full-scale at 20,000 ohms impedance and requires pre-amplifiers for each channel for use with much lower full-scale voltages. It can produce full-scale of 4 digits at the 45 samples per second rate or full-scale of 5 digits at a 9 samples per second rate. The system may be arranged to give up to 5 samples per second on nine input channels or any other arrangement up to the maximum rate of 45 samples per second.

Note: the output device must be compatible with the digitizing rate.

SPECIFICATIONS FOR LOW LEVEL DIGITIZERS

INPUT TYPE

- STANDARD:** Single low level, floating, unipolar, using chopper-stabilized transistorized signal conditioning amplifier
- OPTIONS:**
- A. (BP-30) Bipolar with sign indication
 - B. (SC-30) Multiple scanned inputs with a maximum rate of 2 samples per sec. Higher scanning rates available by special quotation
 - C. (I-30) Multiple input selector-connect 5 units to a single CRS-30

IMPEDANCE

- STANDARD:** 500,000 ohms
- OPTION:** Higher input impedance available by special quotation

SENSITIVITY

- STANDARD:** Single specified fixed range from 10 mv to 500 mv
- OPTIONS:**
- A. (R-30) Switch selectable ranges 10, 20, 50, 100, 200, 500 mv
 - B. Other ranges either fixed or selectable available by special quotation

FREQUENCY RESPONSE

- STANDARD:** 10 cps corner frequency
- OPTION:** Special higher frequency amplifiers available by special quotation

VOLTAGE RESPONSE

- STANDARD:** Linear
- OPTIONS:**
- A. (L-30) Inverse log for Beers Law detectors
 - B. (FG-30) Six point adjustable function former

COUNTING RATE

- STANDARD:** 200,000 cps full-scale
- OPTION:** (VF-30) 1 mc full-scale

MANUAL COMMAND DIGITIZING MODES

- STANDARD:** On command from manual push-button or remote control from external signal with fixed specified measuring interval from 50 ms to 4 min.
- OPTION:** (MI-30) Adjustable measuring interval up to 9 values from 50 ms to 4 min. (data are scaled to give readout independent of the measuring intervals)

REPETITIVE DIGITIZING MODES

- STANDARD:** Repeats cycle of digitizing; then printing or punching data. (requires M-30 memory option to allow digitizing during readout).
- OPTIONS:**
- A. (DP-30) Adjustable digitizing period; 9 positions, 50ms to 4 min; with this option the measuring interval and repetition period are equal but adjustable. As soon as one measuring interval is completed the next interval is started. Data are scaled to give readout independent of digitizing period. (requires M-30 option) Note: The output device must be compatible with digitizing period.
 - B. (RP-30) Adjustable repetition period; 9 positions, 50ms to 4 min. The measuring interval is fixed unless the MI-30 option is also ordered. (requires M-30 memory option if the shortest repetition period does not equal or exceed the readout time plus measuring interval. The output device must be capable of handling the shortest repetition period even with memory.
 - C. (MI-30) Adjustable measuring interval: must be compatible with repetition period whether the repetition period is fixed or adjustable. Operates in both Manual Command and Repetitive digitizing modes. Output scaled to give readout independent of measuring interval.

MEMORY

- OPTION:** (M-30) One sample 5-digit memory for repetitive sampling as required above. Expanded memory available at extra cost.

REPETITIVE READING CAPABILITY

Max rate of repetitive reading is normally limited to 2 samples per second (except for CRS-30 S/N) or by output device, as follows:

P-1 and P-4 printers	1 per sec
T-1 punch	3 per sec
T-2 punch	18 per sec for 5 digits
	22 per sec for 4 digits
T-3 printer/punch	2 per sec
MR-1 magnetic tape	45 per sec
Y-1 typewriter	2 per sec
Slowest standard rate is one reading every 4 min.	
Slower or faster rates depending on output device available by special quotation	

RESOLUTION

- STANDARD:** ± 1 count in 99,999 for measuring intervals of 500 ms or greater. (Otherwise, ± 1 count in [max count rate $\times$ measuring interval])
- OPTION:** (D-30) Addition or omission of digits

SYSTEM STABILITY

- STANDARD:** Zero stability $\pm .005\%$ of full-scale $\pm 2 \mu\text{v}$
- Linearity and Gain Stability $\pm 0.1\%$ of full-scale or $\pm 0.25\%$ of reading whichever is better
- OPTIONS:** Better stability at lower millivolt full-scale values available by special quotation

DIGITIZING METHOD

Uses integrating method giving true averaging during the measuring interval. Precision voltage-to-frequency converter feeding gated electronic counter

TIME BASE ACCURACY

- STANDARD:** $\pm .01\%$ accuracy by frequency standard time base
- OPTION:** (LF-30) counted down power line frequency may be used for larger measuring intervals typically $\pm .1\%$ accuracy

DIGITAL OUTPUT FORM

- STANDARD:** 5 data digits with output to drive any one output device except card punch
- OPTIONS:**
- A. (CP-30) Output coupler for card punch
 - B. (PT-30) Parallel output for two output devices (except card punch)
 - C. (U-30) In-line visual display

OUTPUT UNITS

- STANDARD:** Reads in % full-scale or as otherwise specified
- OPTION:** (C-30) Selectable, adjustable scaling to allow calibration in desired output units.

DIGITAL READOUT ACCESSORIES

P-4	8 digit printer
P-1	10 digit printer
T-1	20 characters per sec paper tape punch
T-2	110 characters per sec paper tape punch
T-3	page printer/paper tape punch, 10 characters per sec
Y-1	electric typewriter, 10 characters per sec
MR-1	incremental magnetic tape recorder

IDENTIFICATION DATA

- STANDARD:** (ID-30) Switch entry of identification data to print or punch
- OPTIONS:** (IC-30) Coding and printing or punching of input channel number

POWER

50-60 cps, 120 volts, 150 watts, typical

SIZE

- STANDARD:** 17" W, 7" L, 17" Deep. Larger size packages may be used where required

SAMPLE NUMBERING

- OPTION:** (N-30) One or several digits may be added to count the readouts consecutively
- Output device must be capable of handling both sample numbering and data.

ADDITIONAL OPTIONS

A-30—Separately packaged single-channel amplifier with integral power supply designed to work with the CRS-30S/N. It has the wide dynamic voltage range with full-scale inputs down to 10 millivolts.

A-30/5—A package of five A-30 type preamplifiers with integral power supply.

Q-30—Parity-error signal output to recorder event-pen (with T-1 punch only).

RI-30—Modifications for installation of CRS-30D with amino acid analyzer recorder.



**INFOTRONICS
CORP.**

7800 Westglen Drive
Houston, Texas 77042

IN-292-SM-666
Printed in U.S.A.

FORM No. IC 402

CRS-12AB

DUAL CHANNEL AUTOMATIC DIGITAL INTEGRATOR FOR AMINO ACID ANALYSES

PROVIDING SIMULTA- NEOUS PROCESSING OF BOTH WAVE LENGTHS

The new CRS-12AB two channel system provides simultaneous digital integration and printout of *both* amino acid analyzer wave length signals. Based on experience-proved amino acid analysis digital integrator designs of the CRS-10AB and CRS-11AB, this new system provides dual channel data processing at a lower per channel cost. All important functions are duplicated. Individual automatic control of both baselines is provided, insuring accurate results for very small peaks. Digital output is a printed list of 440 and 570 m μ peak areas. The instrument may be used on both expanded sensitivity and normal analyzer ranges.



FEATURES

- Simultaneous digital integration of both 440 and 570 m μ signals
- Fully automatic peak detection
- Unattended operation
- Printed list of peak areas
- Operates on both normal and expanded sensitivity analyzer ranges
- Reliable solid state circuit modular construction
- Optional measurement and printing of peak retention times
- Logarithmic/linear conversion of photocell outputs
- Independent automatic control of both baselines
- Recorded event pen monitor on analyzer chart of actual integration intervals
- Compatible with all common types of amino acid analyzers

OPERATION IN AMINO ACID ANALYSIS

The CRS-12AB integrator is connected by shielded cable directly to the 440 and 570 normal millimicron photocell outputs of the amino acid analyzer. An automatic peak detector monitors the sum of the 440 and 570 signals, starts integration at peak beginning and stops integration at peak end. An input amplifier provides isolation from the pipping pen chart recorder. Each data channel incorporates an amplifier, an electronic function generator to effect the Beers Law conversion, and a digital integrator. Integration is accomplished by converting linearized input signals to directly proportional high frequency pulse trains. The number of pulses accumulated in two electronic counters over the duration of the peaks gives values proportional to the 440 and 570 peak areas. Using the common automatic peak detector insures that peaks from the two channels are com-

pared for the same time interval. Data counter values are fed serially to a digital printer for listing. Each channel has an independent built-in automatic baseline corrector to monitor baseline between peaks and correct for deviations from a constant, preset baseline. Baseline stabilization insures accurate integration of very small peaks.

The CRS-12AB determines true peak areas, giving numbers closely comparable to the absorbance (dot-ordinate counting) method of data reduction. Reasonable correspondence with $H \times W$ (peak height times dot-abscissa at half-height) calculations is obtained, although the $H \times W$ method deviates from true area for asymmetrical peaks. The CRS-12AB automatic digital integrator provides excellent reproducibility of results.

CRS-12A AUTOMATIC INTEGRATOR SPECIFICATIONS

- Input ranges: Individually selectable on each channel — 2.5, 5, 10, 20, 40 mv full scale with vernier adjustment continuously from 2.5 to 80 mv
- Input resistance: 500,000 ohms
- Input termination: Can be operated either isolated (floating) or single ended
- Calibration linearity: $\pm 0.7\%$ of indicated O.D. from 0.01 - 2.0 O.D.

Peak height-O.D.

Repeatability

- Typical repeatability of peak area measurements:

0.002 - 0.02	$\pm 2\%$
0.02 - 1.0	$\pm 0.3\%$
1.0 - 2.0	$\pm 1\%$
- Integrator count rate: 1000 counts/sec/O.D.
- Area resolution: $1/1,000,000 =$ six decimal digits
- Peak detection: Fully automatic, monitoring (440 + 570) signal. Adjustable peak detection sensitivity down to 0.002% of full scale mv change per second = 0.0004 O.D./min.
- Peak numbering: Each peak numbered in sequence, 0—9, recycling. Optional—3 digit retention time
- Baseline, zero control: Automatic, independent control for each channel; selectable baseline tracking rates common to both channels
- Baseline stability with drift corrector: Within 0.015% of full scale (15/100,000) or 0.0003 O.D.
- Drift corrector tracking rates: Up and down independently adjustable from 0.0002 to 2 O.D./min.
- Integrating modes: Each channel individually (plus one channel individually if desired)
- Digital printer output: P-4 (Victor) printer, with following three line format (3rd line space)
1 channel of peak no. on left, space, 6 digits of peak area on right
e.g. x xxxxxx 570
 x xxxxxx 440
- Circuitry: Solid state plug-in modules
- Power requirements: Operates from standard 50-60 cps, 115 or 230v. power lines, Approx. 300 watts peak power

EQUIPMENT MODEL NUMBERS FOR ORDERING

- | | |
|------------|---|
| CRS-12AB | Dual channel integrator, 6 decimal digit areas, peak numbering, including baseline correction |
| CRS-12AB/H | With extended dynamic range for GLC operation |
| P-1 | Heavy duty digital printer |
| P-4 | Standard duty digital printer |
| RT-12A | Retention time, 3 digits, in lieu of peak number (requires P-1 printer) |

For complete information, contact



ENGINEERING AND MANUFACTURING

• Digital Electronics • Automation Systems

CRS-70

• **Automatic Digital Data Processing System
For Colorimetric Analyses**

**TWO DATA CHANNEL
MODULE**



PROVIDING

- FULLY AUTOMATIC DETECTION OF MAXIMUM PEAK HEIGHTS
- AUTOMATIC CALIBRATION FOR ALL NORMAL DETECTOR RESPONSES
- SCALING TO READ OUT IN CONCENTRATION UNITS
- ECONOMICAL MULTI-CHANNEL OPERATION—ANALYZERS MAY BE OPERATING SYNCHRONIZED OR NON-SYNCHRONIZED
- PRINTED RESULTS, INCLUDING CHANNEL NUMBER
SAMPLE NUMBER
CONCENTRATION
- OPTIONAL COMPUTER COMPATIBLE FORMATS

 **INFOTRONICS**
CORP.

7800 Westglenn Dr. • Houston, Texas 77042 • Phone: (713) SU 2-9770 • TWX: 713-571-2154

How the CRS-70 System Operates

The CRS-70 is connected directly to the analyzers to be processed and/or to their associated chart recorders. The basic CRS-70/C console unit incorporates controls and power supplies for from 1 to 12 channels. Individual channel modules are added as required, two channels being packaged per module.

CRS-70 systems are capable of automatically calibrating their response, and detecting, digitizing, and printing the maximum peak heights from a multiplicity of simultaneously operating synchronized or non-synchronized colorimeters. The different analyzers may have different sampling rates. It takes about 1.5 sec. to digitize a peak height value, and, e.g., a 12 channel CRS-70 could process peaks at a rate of 1200 per hour.

By means of output scaling controls, the printed results are expressed in the normally used concentration units. Recalibration is automatically effected by feeding a sequence of samples of known concentration to the colorimetric system at periodic intervals. Printed lists include a 2 digit input channel number, a 2 digit sample number on each channel, and five digits of concentration data.

The output of each analyzer is continuously monitored by a peak crest detector which has an

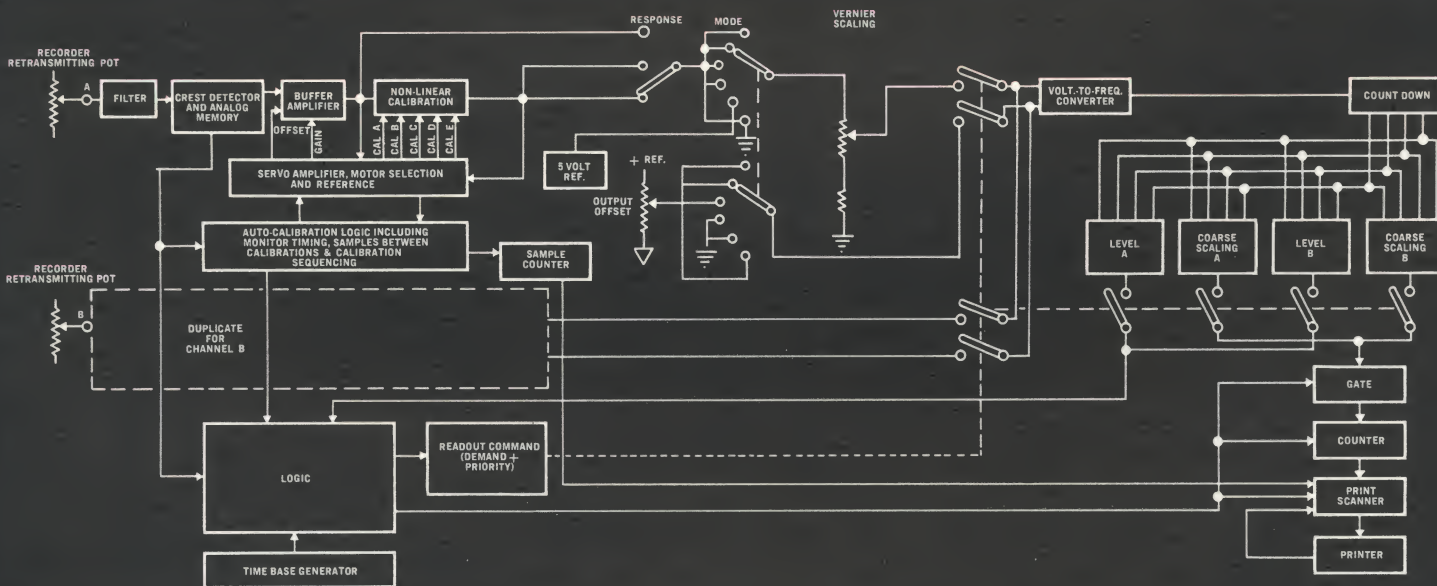
associated memory circuit. Peak maxima are memorized and held until the crest detector indicates that a particular channel is ready for digitizing. A time-shared analog/digital converter is then switched to that channel and a digital peak height value is measured.

Digital values are then transferred for read-out. A variety of outputs are available, including:

- digital printer • computer compatible tape perforator • electric typewriter • card punch coupler • combination page printer/tape perforator.

System operation is fully automatic and functionally simple. CRS-70 controls are pre-set on each channel for the function response desired. Output scaling is also pre-set to provide readout in the desired concentration units for each analyzer. Selector switches are set for the chemical sampling rate of the analyzer and for the sequence of standard samples to be used. The unit then recognizes and digitizes each peak on each input channel, recognizes calibration standards when they occur and adjusts its response as required. The results are a printed list of concentration values in easy-to-read digital format, e.g.,

<u>Channel No.</u>	<u>Sample No.</u>	<u>Concentration</u>
24	16	426.31



The CRS-75 Manually Calibrated System For Single Analyzer Applications

For use with a single analytical instrument, manual calibration may be sufficient or desirable. The CRS-75 is a self contained unit providing automatic peak crest detection and digital readout. It includes controls for output units scaling, i.e., to permit readout in the normally used concentration units. An adjustable function converter permits precise setting of 0, 20, 40, 60, 80, 100 percent concentration points. Manual adjustments may be made without difficulty when standard samples are fed to the analyzer in a routine calibration sequence. The P-1 digital printer provides an economical digital readout for this single channel system.



Magnetic Tape Recording And Processing

A CRS-75 system may be used in conjunction with INFOTRONICS CRS-40 magnetic tape equipment. Analyses are recorded on magnetic tape using CRS-40R series recorders. Playbacks on the CRS-40T tape unit are at high tape speeds, reducing processing time to as little as 1/40 of recording time. The CRS-75 processes

peaks just as if it were connected directly to the analyzer and provides a printed list of maximum peak heights. Identification data, e.g., sample number, can be recorded on the magnetic tapes. Ask for a data sheet on INFOTRONICS CRS-40 magnetic tape data processing systems.

CRS-72 Systems For Computer Data Collection

Where data are to be processed in a digital computer, the CRS-72 provides an economical system for collecting peak crest data in a desired computer compatible format.

All circuitry for automatic peak maxima detection is included. The basic system can process up to 12 analyzer inputs. The computer program performs function conversion, scaling and cali-

bration.

The CRS-72 provides on-the-spot control and easy revision of peak crest detection programs. Signal conditioning is optimized for analytical instruments.

Data collection may be by card punch, paper tape perforator, or combination page printer/tape perforator.

Typical Specifications

Input—Direct electrical signal from detector in analytical instrument or signal from re-transmitting potentiometer on recorder in analyzer system.

Input channels—From 1-12 with CRS-70/C control/power supply unit

Peak crest detection—Fully automatic. Peak maxima stored in analog memory and digitized from memory.

Response calibration—Automatic from standard sample input in CRS-70. Adjustable 5 point response converter in CRS-75.

Analog/digital conversion—Voltage/frequency converter feeding electronic converter gated by 1 sec. time base.

Digitizing interval—Approximately 1½ sec. per sample

Maximum system sampling rate—100/hr./channel

Identification data input—2 digit channel number, switch entry; 2 digit sequential sample number on each channel (pre-wired).

Output units—Scaling to permit readout in normally used concentration units. Five data digits—XXX.XX.

Digital output format

Channel	Sample	Data
XX	XX	XXX.XX

Digital readout—drives one of following output options

- P-1 digital printer
- Y-1 electric typewriter
- T-1 paper tape punch
- T-3 combination page printer/tape perforator
- CP card punch output coupler

How to Order

Several types of CRS-70 systems are available. These include:

Multi-channel, automatic calibration data reduction system for automatic analysis application

Single channel, manual calibration data reduction system

Multi-channel peak crest detection computer data collection systems

In addition a wide selection of digital readouts can be specified, both for printed results and/or computer input. To order, specify the basic equipment control unit and indicate the number of channels required; also specify the digital readout desired.

Automatic Analysis Applications—Multi-Channel, Automatic Calibration Data Reduction Systems...

CRS-70/C Basic control unit and power supply, for 1-12 analyzer inputs. 2 modules, each 10¼" x 20¼" x 22" and 10¼" x 20¼" x 11".

CRS-70/2 Two data channel module, 10¼" x 20¼" x 22".

CRS-70/1 Single data channel module (the CRS-70/2 module is the standard package, hence the CRS-70/1 is in the two data channel package)

For example, to order an 8 channel system, specify

1 CRS-70/C

4 CRS-70/2

Desired digital output

Single Analyzer System, Manual Calibration...

CRS-75 Complete unit, manually adjustable function converter, single 7" x 17" x 17" package

NOTE: To obtain automatic calibration in a single channel unit, specify 1-CRS-70/C, 1-CRS-70/1

Computer Data Collection System, Automatic Peak Crest Detection

(no function conversion, no calibration, no output units scaling)

CRS-72/C Basic control unit and power supply, for 1-12 analyzer inputs, 2 modules.

CRS-72/2 Two data channel module.

CRS-72/1 Single data channel module (in CRS-72/2 package)

Digital Readouts

Printed output

- P-1 digital printer
- Y-1 electric typewriter
- T-3 combination page printer/tape perforator

Computer format output

- T-1 paper tape perforator
- T-3 combination page printer/tape perforator
- CP-70 card punch output coupler (not including punch)

Contact your nearest INFOTRONICS sales/service center or sales representative for assistance in specifying the best system for your requirements.

Form No. 103-2-66



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CRS-50

ANALYTICAL COMPUTATION CENTER

■ COMPLETE AUTOMATIC DATA REDUCTION

- Automatic Integration or Peak Height Digitizing
- Peak Correction and Scaling Factors
- Baseline Correction
- Normalization to Percentage Composition

■ ANALYSIS RESULTS IN PRINTED PAGE FORMAT

■ SYSTEMS FOR ON-LINE OR OFF-LINE APPLICATIONS

For 10 or less analyzers—significantly lower equipment cost and supporting operation costs

■ APPLICABLE TO—

GAS CHROMATOGRAPHY
AMINO ACID ANALYSIS
COLORIMETRY
OTHER ANALYTICAL INSTRUMENTS

■ COMPATIBLE WITH—

INFOTRONICS ON-LINE DIGITAL
INTEGRATORS
CRS-40 MAGNETIC TAPE SYSTEMS
MULTI-CHANNEL DIGITAL INTEGRATORS
—ON OR OFF-LINE



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ADVANTAGES OF THE CRS-50

The CRS-50 analytical computation center adds versatile computing capability to a variety of Infotronics digital integration systems. Real-time digital integration has proved its reliability and versatility in gas chromatography, amino acid analysis, etc., over several years of operation on a wide range of problems. Integration programs can be changed on the spot to meet variations in analysis conditions, and a "hard copy" printed list of peak areas and retention times is immediately available for on-the-spot monitoring.

To complete the typical analysis data reduction program, arithmetic capability is required. Correction and scaling factors often must be applied to individual peaks. Usually the desired final hard copy is a tabular listing of sample components and their percentage composition of the total sample. Such a list should be properly headed by analysis identification data.

The CRS-50 adds the capability for data reduction and tabular data presentation to your Infotronics equipment. The proved advantage of real-time digital integration can thus be combined with the extras afforded by electronic computation.

APPLICATIONS OF THE CRS-50

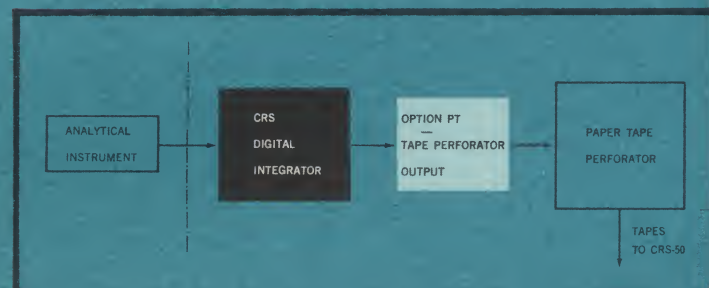
A system comprised of Infotronics digital integrators, peak height digitizers and the CRS-50 analytical computation center performs the following operations:

- Automatic recognition of signal
- Calculation of peak area or moment
- Measurement of peak retention
- Automatic baseline correction
- Function conversion, e.g., Beer's law
- Application of correction factors
- Normalization to obtain percentages
- Printed page tabulation of analysis

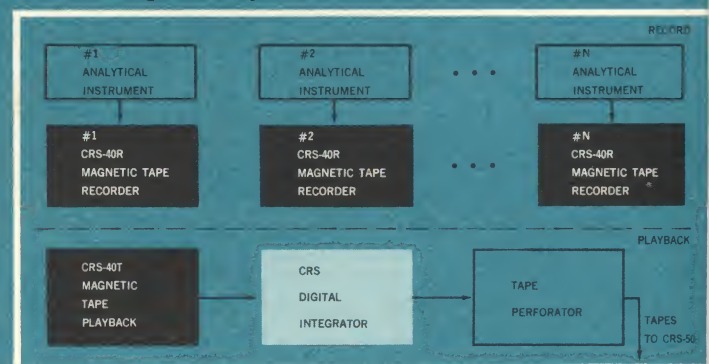
Systems are available for either on-line or off-line computation.

OFF-LINE

1. *Adapted to on-line Infotronics digital integrators*—Paper tape perforators are connected directly to each CRS digital integrator, punching peak area and times, plus identification data if desired, in CRS-50 format. Paper tapes with raw analysis data are processed by the CRS-50.



2. *Working with Infotronics CRS-40 magnetic tape systems*—Raw analysis data plus run identification data are collected on CRS-40 magnetic tape recorders. Tapes from many analyzers are played back in the CRS-40 playback center, which includes a digital integrator or peak height digitizer and tape perforator. Punched tapes of areas (or heights) and times are then processed by the CRS-50 computer at the same analysis center. This approach provides a significantly lower equipment cost per analyzer.



peaks—start, end, crest, shoulders
 measurement of peak heights
 times

Law to linear, if required
 to individual peaks or groups of peaks
 tage composition for each component
 ysis results

itation. Here are some examples:

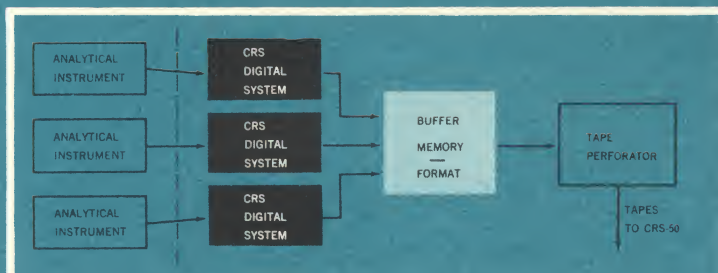
3. *Special multi-channel Infotronics digital integrators*—A tape perforator can be shared among several Infotronics integrators or peak height digitizers, multiplexing data on the paper tape. Common packaging of the digitizers provides cost savings in some applications. Again, tapes are processed by the CRS-50.



DESIGN FEATURES OF THE CRS-50

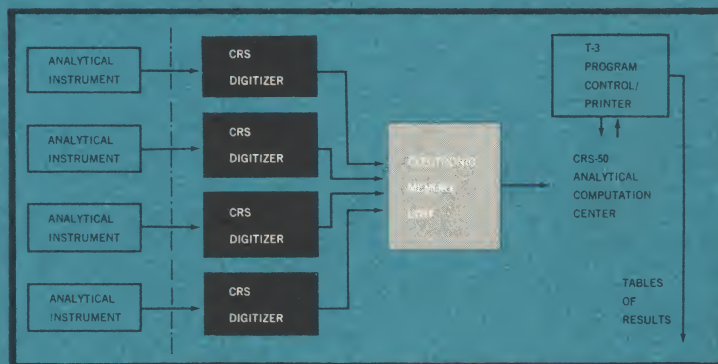
The CRS-50 is *optimized* for analytical data processing, particularly continuous column effluent applications—gas chromatography, amino acid analysis. These features are important to you:

- Fully solid state electronics, with plug-in modular construction for ease of maintenance
- Computing capacity scaled to the analytical problem, enough to do the job, at a reasonable cost
- Adaptable to existing Infotronics CRS systems—digital integrators (CRS-10's, -11's, -12's), peak height digitizers (CRS-30's, -70's), magnetic tape systems (CRS-40)
- Flexible system design, permitting cost economy and operational streamlining to fit specific problems
- Use of field proved digital integrators permitting revision of operating programs on the spot
- For small volume applications, up to 10 analyzers, significantly lower initial equipment cost and supporting operating costs—staff, programming, etc.



ON-LINE

Multiple channel digital integrators or peak height digitizers can be interfaced directly to the CRS-50 analytical computation center by using the model M-100 electronic memory. Peak areas are stored in the M-100 and sequentially processed by the CRS-50. Operation is fully automatic. Cost depends upon the number of analyzers involved and the number of peaks. For relatively small groups of analyzers, i.e., less than 10, Infotronics systems provide significant cost savings vis-a-vis digital computer systems.



HOW THE CRS-50 OPERATES

ANALYTICAL DATA INPUT

Raw analysis data consists of peak areas or maximum heights and peak times. These are fed to the CRS-50 in two ways—

off-line—from punched paper tapes

on-line—from M-100 electronic memory units

COMPUTATION PROGRAM

The CRS-50 performs the following operations:

Peak correction— $a_i A_i$, where the A_i are the raw peak areas, and the a_i are the correction constants

Calculation of corrected total area— $\sum_N a_i A_i$, where N is the number of peaks in an analysis

Normalization

$$A_i' (\%) = \frac{a_i A_i}{\sum_N a_i A_i} \times 100$$

where $A_i' (\%)$ is the percentage composition of the peak representing component i .

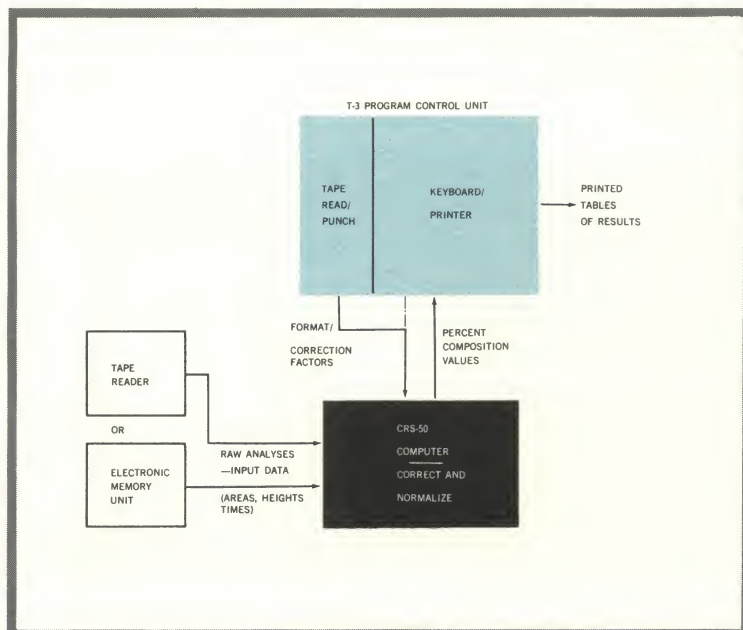
Format and program preparation—The percentage values are listed in tabular form, using the T-3 (Teletype) page printer. This unit reads format programs (column headings, component designations, etc.) and feeds them to the CRS-50 calculator. The T-3 keyboard permits preparation of format and correction factor programs as required in the form of punched paper tapes. These are read by the CRS-50 as raw analysis tapes are being read. Correction factor programs may be prepared, e.g., as follows:

—factor j applies from peak no. i to $(i+n)$

—factor j applies for retention time zone t_i to $(t_i + \Delta t)$

Logic control—an Infotronics logic unit provides system control. This unit selects the proper program for a given analysis and synchronizes feeding of analysis data and program data to the calculator.

Computation unit—Calculations are carried out in a solid state circuit, electronic calculator, equipped to accept data from the T-3, from paper tape recorders and from the M-100 electronic memory.



TYPICAL RESULTS

ANALYSIS NO. 12345		PROGRAM NO. 56		SAMPLE SYNTHETIC #124	
TIME	PK AREA	SCALING	CORR AREA	PERCENT	COMPOUND
280	053342	.860	045952	23.04	P09
326	052991	.845	043925	22.06	P12
391	068036	.830	056480	28.34	P15
463	064501	.815	052551	26.40	P18
554	000206	.800	000165	00.08	P19
TOTAL			199073	99.92	

FORM No. 101-2-66

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